THE RELATIVE CONTRIBUTION OF PROTEIN vs LIPID AND MEAT vs MICROBES TO FLAVOUR DEVELOPMENT IN DRY AND FERMENTED SAUSAGE.

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Background and objective.

Apart from safety, flavour is the characteristic receiving most attention in research on the quality of dry and fermented sausages. Research reports mainly involve analyses of volatile components and the identification of bacterial and/or fungal starters interacting with the oxidation of polyunsaturated fatty acids and the production of selected volatiles from amino acids, mainly from leucine. It is clear however that meat enzymatic activity and non volatile components also significantly contribute to flavour development with possibilities for the optimisation of flavour through selection of both microbial starters and raw materials. Objective. It is hoped to present a comprehensive summary of the possible contribution of meat enzymes to proteolytic and lipolytic changes in flavour development and to present preliminary data on animal factors possibly underlying the variability of such contribution. Results to be presented, will be mainly derived from work of the author's laboratory within the FAIR CT97 3227 project, presented elsewhere at this Congress (Demeyer, 2000). Pertinent references can be found in Demeyer et al (2000).

Protein and lipid as flavour precursors.

Flavour is a complex sensory reaction involving taste, smell (odour or aroma) and texture of a product. It is evaluated through descriptive sensory profiling by a panel specifying and quantifying a series of descriptors such as bitter, rancid, salty , salami and mature. The relationship beween such sensory data and chemical analyses can be investigated by calculation of correlations using multivariate statistics. Also, individual compounds can be characterized by "sniffing" (olfactometry) of individual fractions, isolated by gas or liquid chromatography.

Volatiles and aroma. Depending on the method of isolation, more than 200 different compounds can be isolated, usually dominated by spice and smoke derived compounds. Compounds derived from lipids involve both alkanals (mainly hexanal) and alkenals, as end products of lipid (auto) oxidation as well as methyl-ketones, considered to be products of microbial beta-oxidation of saturated fatty acids. They are followed in importance by compounds derived from bacterial amino acid metabolism, mainly 2- and 3-methyl butanal. Although the relation of all compounds to sensory data is far from clear, the latter two groups have been clearly associated with descriptors such as maturity and salami and their relative importance, as well as that of esters, is increased by the Mediterranean low temperature and long time ripening process with use of *Staphylococci* as starter organisms. Higher temperatures and the use of *Pediococci* as lactic acid producing starters promote the production of dairy related volatiles such as diacetyl and accelerate the rate of pH drop, inhibiting *Staphylococci*.

Water solubles and flavour. Work has mainly involved the analysis of the peptide and free amino acid fraction and limited olfactometry data have associated small peptide (< 500 D) and amino acid containing fractions isolated by gel permeation chromatography with sensory descriptors such as salami and bouillon, in analogy with the known importance of such fractions for raw ham flavour. The contribution to flavour of ATP metabolites such as IMP and hypoxanthine is also recognized and that of free higher fatty acids generally considered of less importance. Studies on the relative importance of volatiles and water solubles should use multivariate statistics involving data sets for both, volatile and water soluble compounds.

Meat enzymes in protein and lipid changes.

Protein changes. The use of antibiotics and paucibacterial meat incubations has clearly established that initial proteolytic changes mainly involve myosin and actin degradation through the action of cathepsin D like enzymes. The contribution of bacteria in further endo- and , mainly, exoproteolytic changes increases down to ammonia production, the end of the proteolytic chain. Mediterranean, low temperature ripening, lowers rate of pH drop and thus, cathepsin D activity and initial protein degradation, but further proteolysis is not affected. Paucibacterial meat incubations demonstrate free amino acid production by meat enzymes.

Lipid changes. In similar experiments, it was clearly demonstrated that endogenous lipases are by far the main responsible enzymes for the liberation of free fatty acids during ripening, with preferential release of poly-unsaturated fatty acids, both because of the more important phopholipase activity on muscle membrane phospholipids and the specificity of fat cell lipases. The importance of lipolysis for lipid oxidation and thus, flavour, remains unclear but a promoting effect is often assumed.

Variability in animal enzyme activity.

It is well known that phospholipid polyunsaturated fatty acid composition in pork is affected by diet. Such changes will be reflected in the pattern of lipid oxidation end products, and thus, probably affect flavour. It was demonstrated in practical sausage ripenings, paucibacterial meat incubations as well as by muscle enzyme activity measurements that proteolytic and lipolytic activities of muscle show considerable variation, related to anatomical location, gender, animal age and post-mortal rate of pH drop. The effects of such variability on flavour development should be further investigated.

References

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